

## NCE Automotive N-Channel Super Trench Power MOSFET

### Description

The series of devices uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

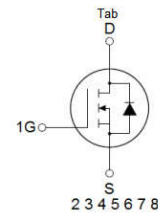
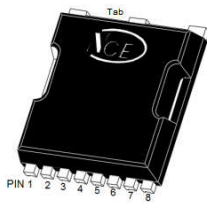
### Application

- Automotive application
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

### General Features

- $V_{DS} = 40V, I_D = 360A$  (Silicon Limited)  
 $R_{DS(ON)} = 1.1m\Omega$ , typical @  $V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested
- 100%  $\Delta V_{ds}$  tested
- **AEC-Q101 qualified**

TOLL-8L



Schematic Diagram

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
AP40T20ALL	NCEAP40T20ALL	TOLL-8L	-	-	-

### Absolute Maximum Ratings ( $T_c = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous(Silicon Limited) <sup>(Note1)</sup>	$I_D$	360	A
	$I_D(100^\circ C)$	255	A
Drain Current-Continuous(Package Limited)	$I_D$	250	A
Pulsed Drain Current	$I_{DM}$	1000	A
Maximum Power Dissipation	$P_D$	300	W
Derating factor		2.0	W/°C
Single pulse avalanche energy <sup>(Note 2)</sup>	$E_{AS}$	1692	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	°C

### Thermal Characteristic

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.32	0.5	°C/W

## Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	40	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =40V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0	3.0	4.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	-	1.1	1.35	mΩ
Gate resistance	R <sub>G</sub>	F=1.0MHz	0.2	3.5	6.0	Ω
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =100A	-	90	-	S
<b>Dynamic Characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, F=1.0MHz	-	5834.6	-	pF
Output Capacitance	C <sub>oss</sub>		-	2320.5	-	pF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	70	-	pF
<b>Switching Characteristics</b> (Note 1)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =20A V <sub>GS</sub> =10V, R <sub>G</sub> =1.6Ω	-	14.5	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	8	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	58	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	10	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =20V, I <sub>D</sub> =20A, V <sub>GS</sub> =10V	-	91	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	29.4	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	19	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =20A	-	-	1.2	V
Diode Forward Current	I <sub>S</sub>		-	-	250	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = I <sub>S</sub>	-	-	38	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs	-	-	125	nC

### Notes:

1. Defined by design. Not Subject to production test
2. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=20V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω
3. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=175°C. The SOA curve provides a single pulse rating.

## Typical Electrical and Thermal Characteristics

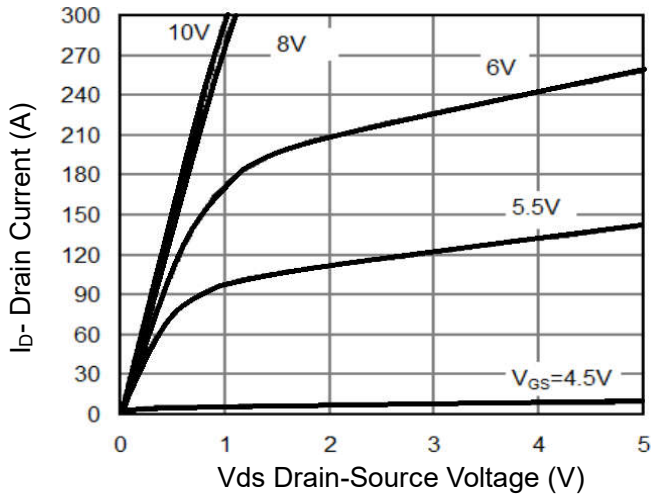


Figure 1 Output Characteristics

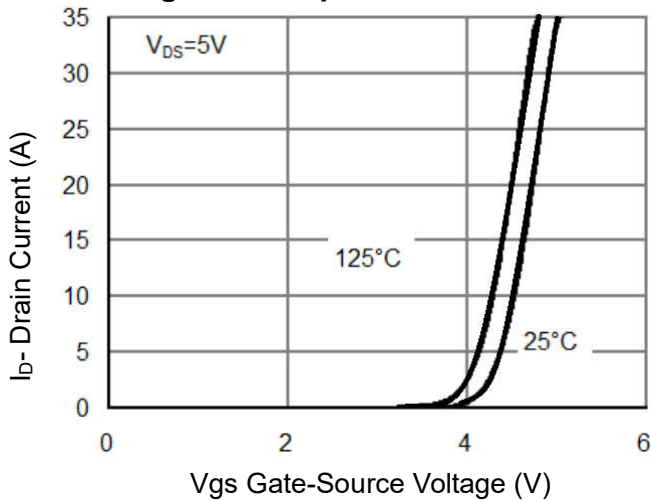


Figure 2 Transfer Characteristics

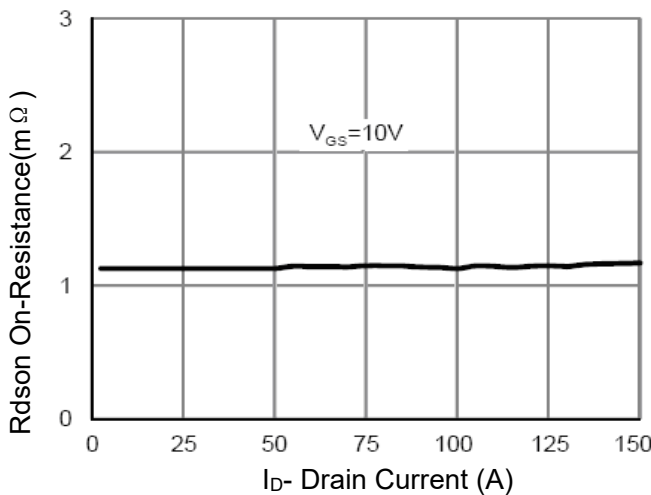


Figure 3  $R_{DS(on)}$ - Drain Current

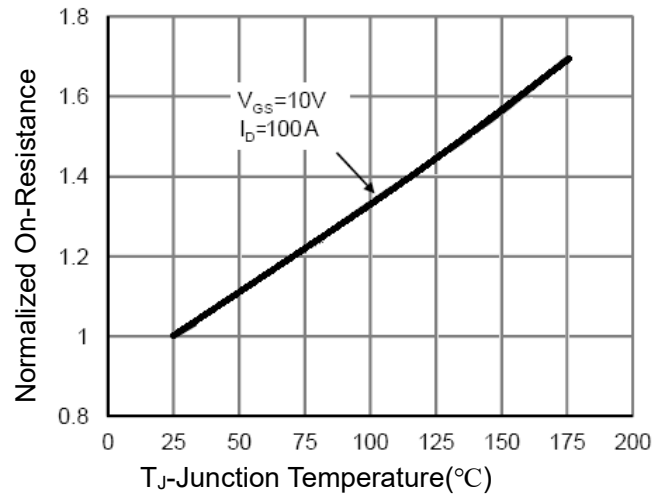


Figure 4  $R_{DS(on)}$ -Junction Temperature

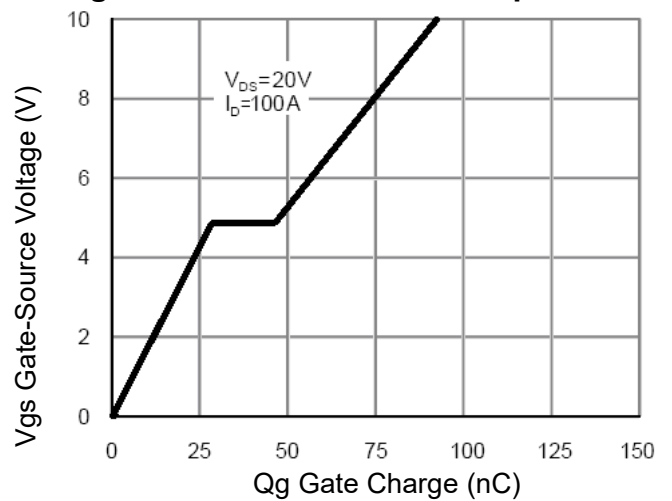


Figure 5 Gate Charge

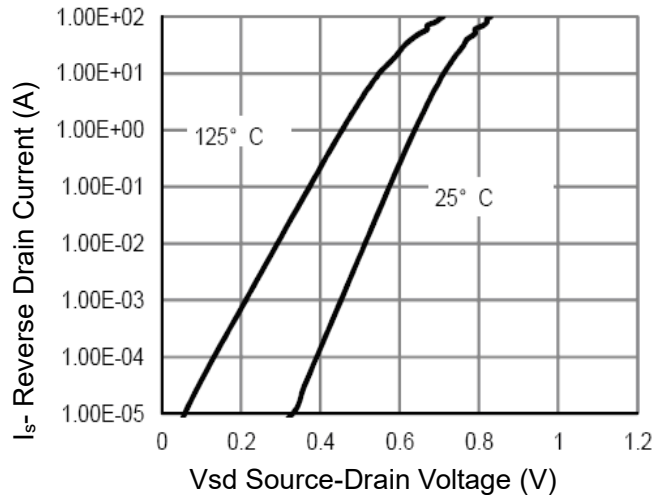
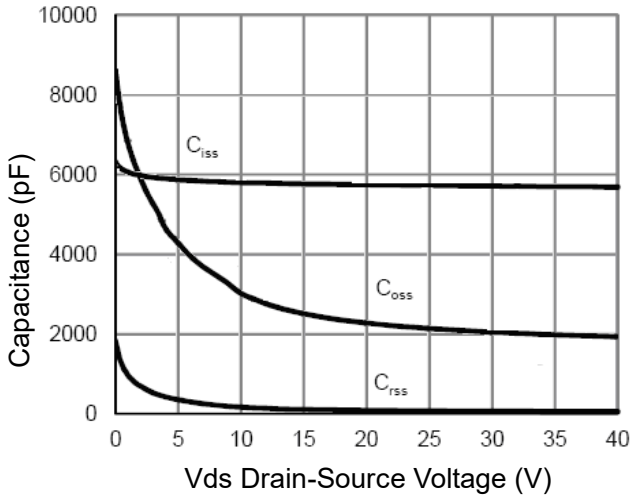
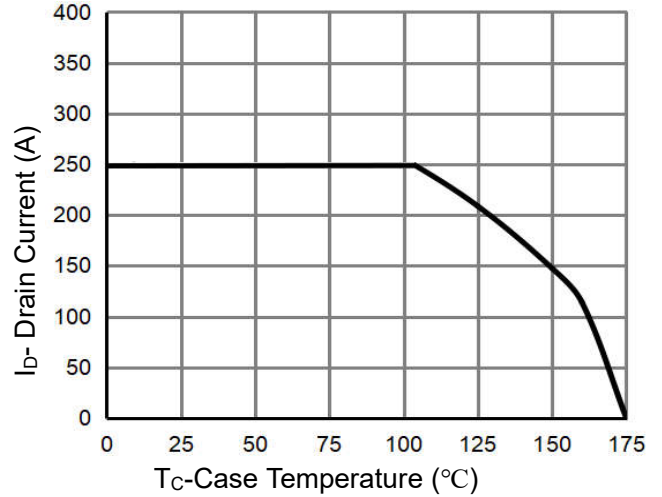


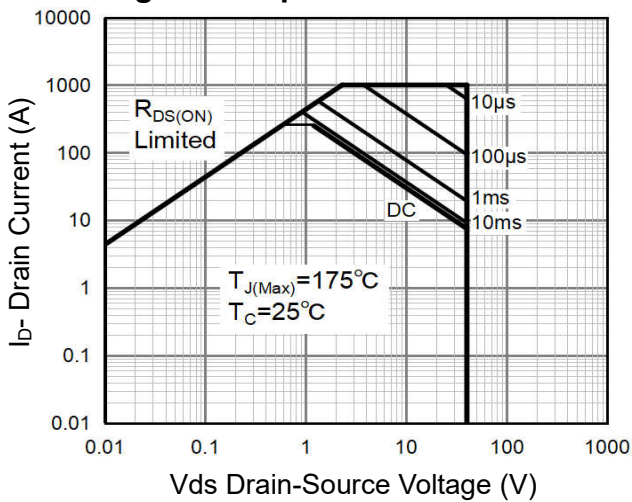
Figure 6 Source- Drain Diode Forward



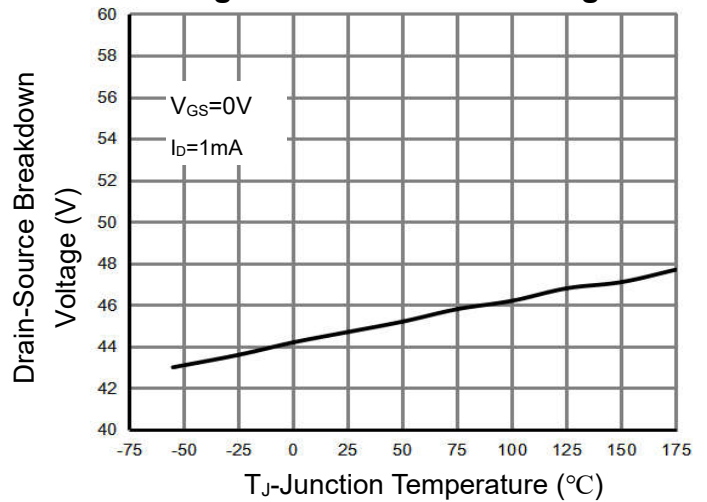
**Figure 7 Capacitance vs Vds**



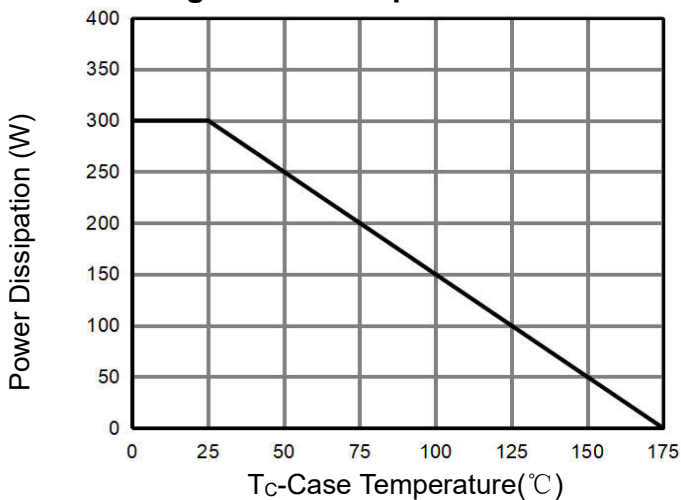
**Figure 10 Current De-rating**



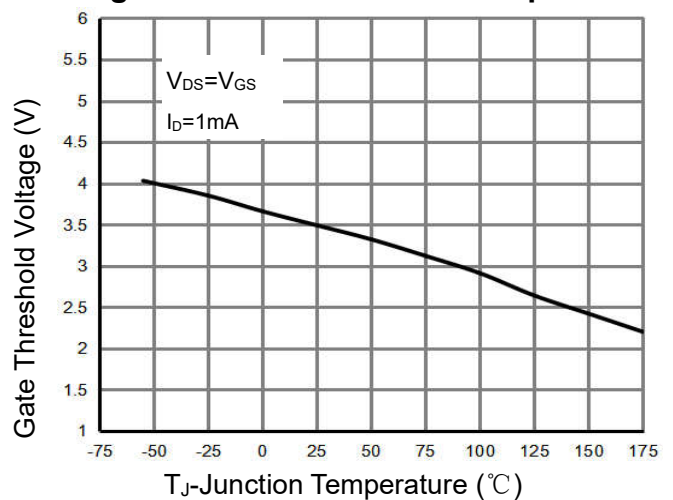
**Figure 8 Safe Operation Area** (Note 3)



**Figure 11 BV<sub>DSS</sub>-Junction Temperature**



**Figure 9 Power De-rating**



**Figure 12 V<sub>GS(th)</sub>-Junction Temperature**

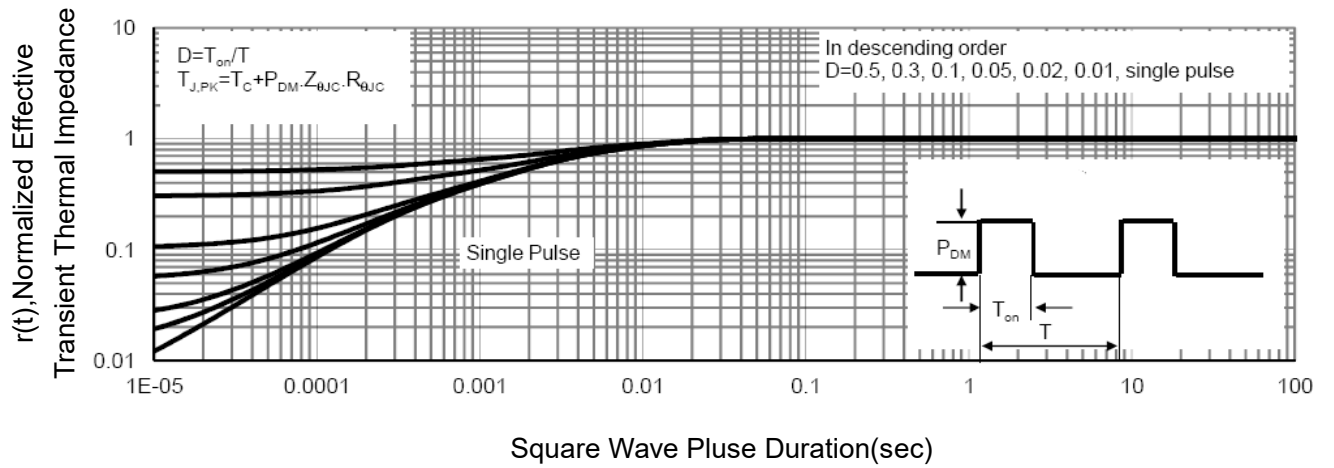
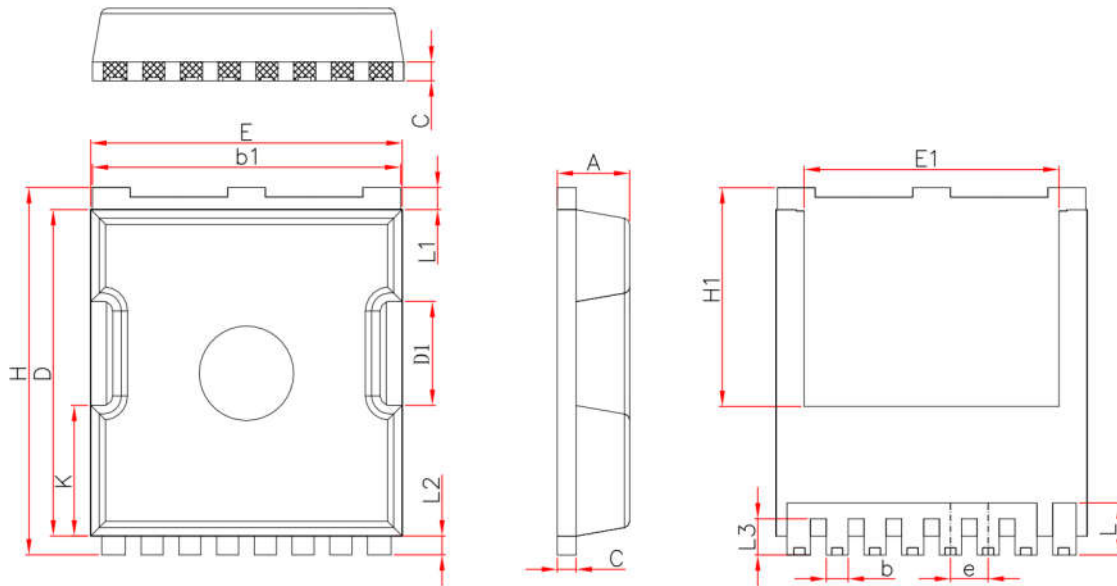


Figure 13 Normalized Maximum Transient Thermal Impedance

## TOLL Package Information



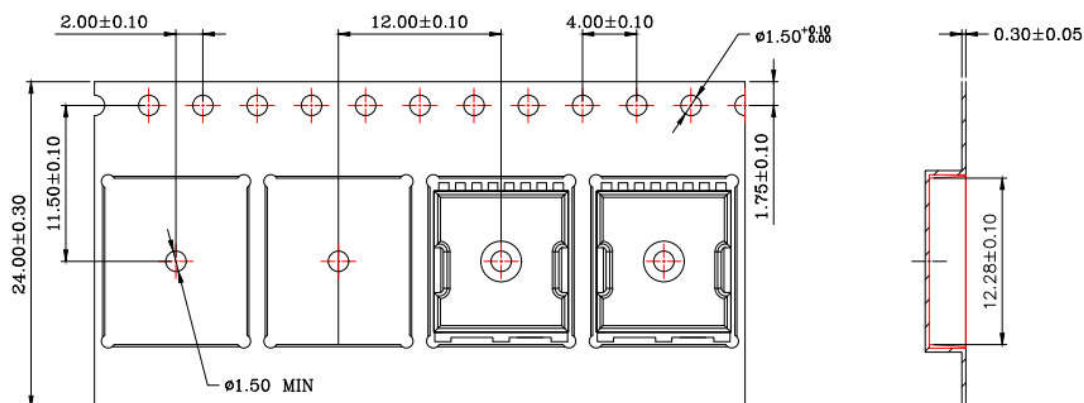
Symbol	Millimeters		
	Min.	Nom.	Max.
A	2.20	2.30	2.40
b	0.65	0.75	0.85
b1	9.70	9.80	9.90
C	0.50	0.60	0.70
D	10.30	10.40	10.50
D1	3.15	3.3	3.45
E	9.70	9.90	10.10
E1	8.00	8.10	8.20
e	1.10	1.20	1.30
H	11.6	11.7	11.8
H1	6.85	6.95	7.05
K	4.08	4.18	4.28
L	1.60	1.65	2.10
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	1.05	1.20	1.30

NOTES:

- 1.FOLLOW JEDEC STANDARD MO-299B.
- 2.ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSION.
3. Exposed Cu

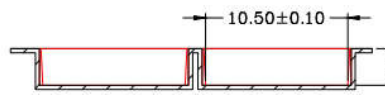
## Package information

### 一、载带图纸:



**Notes:**

1. All dimensions are in mm.
2. Material: Black Conductive Polystyrene Alloy
3. 10 sprocket hole pitch cumulative tolerance  $\pm 0.20\text{mm}$ .
4. Carrier camber is within 1 mm in 250 mm.
5. Packing length per 19" reel : 196.0 Meters.
6. There must not be foreign body adhesion and the state of the surface must be excellent.
7. Surface Resistance  $1 \times 10^5 \sim 1 \times 10^{11}$  OHMS/SQ



### 二、包装信息表（满箱信息）

封装形式	包装方式	盘尺寸	只/盘	盘/内盒	只/内盒	内盒/箱	只/箱
TOLL	编带	13 寸	2000	1	2000	8	16000

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